ILLINOIS POLLUTION CONTROL BOARD
November 7, 1985

IN THE MATTER OF:	)	
	)	
GENERAL MOTORS CORP.	)	
PROPOSED AMENDMENTS	)	R83-7
TO 35 ILL. ADM. CODE	)	
900.103 AND 901.104	)	

PROPOSED RULE. FIRST NOTICE.

PROPOSED OPINION AND ORDER OF THE BOARD (by J. Anderson):

Procedural History

This matter comes before the Board on the petition for change of the Board's noise regulations, filed by General Motors Corporation (GM) February 24, 1983 as amended April 13, 1984. In summary, GM proposes amendments to 35 Ill. Adm. Code 900.103(b) "Measurement Procedures" applicable to Part 901 to require use of one hour Leq averaging in determining compliance with the regulations (except for blasting noise), as well as correction of measurements for ambient noise, and amendment to 35 Ill. Adm. Code 901.104 "Impulsive Sound" by deletion of the required measurement by "fast dynamic characteristic" in conformance with the proposed amendment to Section 900.103(b).* GM's assertion is that these amendments are necessary to insure correct implementation of the Board's intention in adopting the original noise regulations that sound measurements used to assess compliance be "in substantial conformity with standards ... established by the American National Standards Institute, Inc. (ANSI)", See R72-2, In The Matter Of: Noise Pollution Control Regulations, Order of July 23, 1973, Opinion of July 31, 1973, p. 23.

Merit hearings were held on this proposal on June 22, and November 22-23, 1983, at which some economic data were presented. No separate economic impact hearings have been held, given the determination of the Department of Energy and Natural Resources (DENR) that:

*This Opinion refers to the rules as renumbered upon codification; the record in part refers to the old rule numbers. The initial proposal referred to the applicable rules prior to codification, then numbered as Rules 103 and 206 of the Chapter 8: Noise Regulations. Prior to codification, Rule 206 "Impulsive Sound" was renumbered to Rule 205 in R76-14, and upon codification was renumbered to Section 901.104. Old Rule 103 was codified as 901.103.

> "While it may be possible to quantify some of the costs and benefits of R83-7, such a study would be costly and would probably not contribute much beyond what has already been entered into the record. Therefore, the following criterion specified in Section IV(d) of PA 83-468 applies in this matter:
>
> > The cost of making a formal study is economically unreasonable in relation to the value of the study to the Board in determining the adverse economic impact of the regulation."

(DENR Letter of 12-23-83; see also DENR Letter of 3-12-84.)

Post-hearing comments were filed by GM on April 13 and June 15, 1984, and by the Illinois Environmental Protection Agency (Agency) on May 3, 1984. GM, the Agency, and DENR were the only active participants in this proceeding. Testimony on GM's behalf was presented by Richard R. James, former Vice President of Total Environmental Systems, Inc. (TES), a noise consulting firm; James H. Pyne, GM Staff Engineer in Plant Engineering and Development, Advanced Product and Manufacturing Staff, who is responsible for overseeing and directing GM's Noise Control Program; Roy F. Larson, Environmental Coordinator at the GM Central Foundry in Danville; and Woodford Van Tifflin, Supervisor of Engineering in Plant Engineering Programs, GM Central Office. Limited testimony in response to Board questions was given on behalf of the Agency by Major Hearn, Jr.

Factual Background Prompting the GM Proposal

GM's Illinois operations include a gray iron foundry located partially in Danville and partially in Tilton, a Fisher Body plant in Willow Springs which fabricates and assembles automobile bodies, and two Electro-Motive plants: Plant #1 in La Grange, which fabricates and assembles diesel-electric powered railroad locomotives, power generating units for petroleum drilling rigs, and diesel power sources for various applications, and Plant #2 in Chicago, which primarily fabricates and welds primary engine and electric motor components. Data from noise surveys at the Danville plant were those primarily used to exemplify GM's concerns with the wording and implementation of the existing rules, although some data from the other plants was also discussed.

The Agency began an investigation of noise emissions at GM's Danville facility in 1978, as a result of a complaint in February, 1978 from a Tilton resident, Mr. Wayne H. Powers, who complained of a "high pitch tone sound[ing] like very large electric motors". As a follow-up to the complaint the Agency

contacted eight other residents, 5 of whom shared Mr. Powers' complaint. See Agency Comments of 5-3-84, p. 6 and Attach. 3-4.

The record of Agency monitoring activities at Danville shows that there were at least seven field trips to acquire data. Measurements were taken pursuant to the criteria adopted by the Agency pursuant to Section 900.103(b) on February 8, 1980 (Exh. C). The first trip was on May 17, 1978, and the most recent was on January 29, 1981. Exhibit "L" summarizes the first six trips, which covers eight tests. The ninth test was on January 29, 1981. Exhibit "L" shows each of the test dates, the time spent by the Agency staff on site, the type of analyzer used, the total sample length (period of observation), range of levels (or "average" level) in the 160 Hz 1/3 octave band, and the delta (or range of deltas) used to define the presence of a prominent discrete tone. The January 29, 1981, test was conducted between the hours of 11:30 a.m. and 1:30 p.m. Visual observations of levels were made with a B&K 2209 SLM and 1/3 octave filter set. The data was also tape recorded for subsequent analysis. This analysis consisted of 3 sample periods covering 116 seconds of data from the B&K 2131, which was set to an averaging time of one second. The range of levels in the 160 Hz 1/3 octave band was 62 to 66 dB, with the deltas ranging from 7 to 14 dB.

Data collection and analysis followed one of two methods. Exhibit "L" shows the method used by the Agency for each test, by referring to "Filter and SLM (Fast or Slow)," or "Taped B&K 2131." The first method involved visual reading of the sound level in each 1/3 octave band directly from the readout meter of the B&K 2209 sound level meter, equipped with a B&K 1616 1/3 octave band filter set. No record was provided of the period of observation or methodology used to determine the reported levels. The second method involved tape recording the community noise at the test sites. This recording was subsequently analyzed at an Agency laboratory.

The typical analysis procedure, as described on page 5 of the Agency's Noise Survey Report, is shown in Exhibit "M." It documents the Agency's data collection and analysis procedures for the testing conducted on July 18, 1979, as follows:

> "The data was accumulated using the Nagra IV-SJ taperecorder and magnetic tape at 7.5 inches per second tape speed on fast channel #1. The data was analyzed by playback of the magnetic tape on the same recorder (Nagra IV-SJ) at the same speed (7.5 ips) into the Bruel and Kjaer model 2131 Digital Frequency third-octave analyzer. The 2131 supplies the information to the Hewlett Packard 9825A calculator. The calculator has been programmed to accept the information and apply all correction factors, except those necessary due to ambient SPL's and print the corrected

> data in 1/3 octaves and summed octave bands. The HP 9825A printouts are included in this report. Several averaging times were used on the noise source. The important fact is that over a 32 second averaging time the prominent discrete tone is still present. Thereby indicating, the pure tone can be characterized as constantly present."

Two different averaging times were used. Three sets of data samples were each averaged for one second, and one set of data was averaged over a 32-second period. The 32-second sample was in compliance with both Rules 202 and 207.

The physical noise environment is complex. In addition to noise produced by GM, there are noise emissions from motor vehicles on I-74, which at that point has a major on-off ramp and is elevated on a high berm, as well as in-town traffic, and noise emissions from the railroad lines and one switchyard located to the east and south.

The source of the "high pitch tone" was determined to be the cupola fume control systems at stacks 1, 2 & 3. The schematic provided as Exhibit "H" shows the 2000 HP fan which draws cupola emissions through the scrubbers. The fundamental tone of this fan is related to the fan RPM and the number of fan blades. For this fan, which is used on all three stacks, this tone is at 158 Hz.

In response to discussions with the Agency in 1978, GM installed on an experimental basis a corrosion-resistant Industrial Acoustic Silencer in the No. 2 cupola. This did not correct the violation noted by the Agency and completely disintegrated in the stack within 14 months after installation. Testimony of W. Van Tifflin, p. 6, and Exh. E. According to the Agency, (comments, p. 7) "several", unspecified operational changes were also unsuccessfully implemented. On May 23, 1980, the Agency issued a "Notice of Enforcement" (Exh. E) alleging violations of then Rules 101, 202, and 207 concerning noise nuisance, emission of sounds from Class C to Class A land, and prominent discrete tones. No enforcement action has ever been brought before the Board. This does not reflect Agency judgment that any problem has been solved, but instead reflects the severe cutback in the Agency's Noise Control Staff which is the result of the demise of the Federal Noise Program and its funding for state enforcement efforts. See Agency Comments, p. 13-19. The Agency has "pressed" for installation by GM of stack silencers (Id. p. 7).

GM has investigated this option, and believes that stainless steel silencers produced by TLT Babcock are the most feasible option. Capital, installation and maintenance costs will require an expenditure of $142,358 per year (in 1983) for every year in which GM continues to operate, due to the need to replace the

silencers every five years due to corrosion. The silencers are designed to hypothetically achieve a 24 dB reduction at the cupola. Based on extension measurements in Mr. Power's yard (described in more detail below), GM asserts that the effective reduction of noise to that receiving source is 4 dB, due to the masking of the sound from the cupola by ambient, non-GM noise sources. GM further asserts that installation of such equipment to achieve compliance with the numerical limits Part 901 (as opposed to the noise nuisance of Section 900.102) is economically unreasonable, based on its belief that the Agency's noise measurement and analysis procedures do not correctly measure noise emissions as intended by the Board in adopting the noise regulations. See, generally, testimony of W. Van Tifflin.

GM notes that, based on sound measurements in 1981 at its two Electromotive and its Fisher Body plant, by using the Agency measurement techniques as employed at the Danville plant, that a measurer could find violations of the Board' prominent discrete and impulsive sound rules. GM does not seek site specific relief for each of its four plants, believing that non-ANSI complying flaws in the measurement affect not only GM, but the rest of the regulated community as well. GM's basic position, then, is that as a "good corporate citizen" the responsible position for it to take is to correct the generally applicable flaws it perceives, rather than to attach only its specific "compliance" problems.

GM's Asserted Flaws In Agency Measurement and Analysis Techniques

ANSI S1.13-1971 (Exhibit D) requires that the measuring technician measure sound over a sufficient period of observation to obtain a statistically representative sound level; it does not specify the length of the observation period. It also requires corrections for ambient sounds which are measured along with the source in question.

ANSI S1.13-1971 provides methods for determining the true root mean square (rms) values of the sound level for a specified period of observation. The rms sound pressure level is also known as the "log average sound pressure level," "equivalent continuous sound pressure level," and "Leq" when referring to the equivalent continuous sound level. For reasonably steady sounds this value is indicated by the position of the meter needle or digital readout value of the sound level meter. When fluctuations in the meter readout due to variations in the sound's amplitude preclude direct readout, ANSI S1.13 provides procedures for estimating the true rms value that work well, when the variation in the sound level over the period of observation is reasonably stable and sinusoidal. ANSI's formula for averaging independent samples is:

$$L = 10 * LOG \left[\frac{1}{N} \left(\sum_{i=1}^{N} 10^{(L_i/10)} \text{ dB} \right) \right] \qquad \text{Eq. 1}$$

Where: N = total number of observations
L_i = the level at each observations.

ANSI S1.13 recommends that if the time scale of the fluctuations is such as to make this procedure impractical, other techniques, such as direct computation of the rms value by analog or digital means, are required. The digital method utilizes an algorithm conceptually similar to the above formula.

GM asserts that the Agency's measurement procedures, adopted February 8, 1980, under Rule 103(a) [Exhibit "C"], follow ANSI S1.13 very closely, often paraphrasing whole sections of the standard -- except at one very important point. The Agency modified Equation 1 to make the input values for L_i the maximum levels observed, not the statistically independent samples intended by ANSI. This means that value "L" is no longer the true mean rms level. Now "L" is instead the log average of the maximum values. It will thus always be greater than the rms value desired, with the discrepancy increasing as the magnitude of the fluctuations increase and as the pattern of the variation in level deviates from sinusoidal.

GM further asserts that there was also a discrepancy in Agency laboratory procedures. This deviation occurs in the HP 9825A computer program, where the sample output levels from the B&K 2131 are averaged and printed out. This deviation occurs because the HP 9825A computer program is written to arithmetically average the levels. Thus, equation 1 was changed to read, for the Agency's measurements at Danville, to the following:

$$L = \left[\frac{1}{N} \left(\sum_{i=1}^{N} L_i \right) \right] \qquad \text{Eq. 2}$$

Where: N = total number of samples
L_i = the level of the sample output from the B&K 2131.

This equation is not in agreement with either the published Agency measurement procedures of February 8, 1980, or the ANSI S1.13-1971 methods for determining the true rms sound pressure level.

GM/TES FINDINGS AT DANVILLE

A comprehensive study of the impact of the Danville plant's noise emissions on the Tilton community environment was conducted jointly by General Motors' and TES personnel. Data were collected jointly by GM representatives and analyzed by TES. The last completed test sequence documented noise levels over a 24 hour period, at the primary test site that was also used by the Agency - Mr. Power's yard.

Exhibit "N" presents the results of the 1980 Power's yard tests as log-mean-average sound pressure levels, plus or minus one standard deviation. The data representing each cupola's noise emissions has been separated into two tables. The upper table shows the cupola noise emissions in conjunction with traffic and railroad activities. The lower table shows the average levels in each 1/3 octave band from the data analysis conducted to separate the plant noise from other ambient noise sources. This table presents the levels in the bands adjacent to the cupola noise out of context of the ambient environment. However, this is a necessary step in defining the 1/3 octave band containing cupola noise components, to judge the effect of noise control changes. A method similar to that used by the Agency was used in analysis, although the GM/TES averaging was done logarithmically, typically over periods of 16 seconds or more, and was not limited to only the maximum levels observed.

When GM/TES sampled for the "with-ambient" condition, they typically averaged uninterrupted periods of 3.4 minutes or 6.8 minutes. Mr. James used an 'ear and eye' judgment to select single samples to make up a composite, "without-ambient-noise" period. This was done by sampling when he both heard the tone and could see that the 158 Hz spike was not affected by other noise components in the 160 Hz 1/3 octave band. These tables represent the average of all the 1980 data (representing normal operations) that they have analyzed from TES test site tapes at Power's yard.

There are significant differences between Exhibit N values and those documented by the Agency.

The 1981 data is the most comprehensive of all. This test involved 8-1/2 hours of tape-recorded data, taken beginning the evening of June 30, 1981, and ending approximately 24 hours later, late in the afternoon of July 1, 1981. The taping sessions were usually 1-1/2 to 3 hours long, and were timed so as to record significant operating periods. Taped data included samples from early evening, late night through to shut down after midnight, early morning start-up, midday, and late afternoon. These tapes were analyzed to determine the 15-minute equivalent continuous sound pressure levels in the frequency bands of interest.

Environmental conditions during data acquisition placed the test site downwind of the plant. This condition favors propagation of plant sounds toward the test site.

GM asserts that the importance of the results of this test period is in the observed short-term variations in the community sounds and the acceptable degree of contribution from the foundry cupolas when evaluated over a longer period of observation. The level of the 160Hz 1/3 octave band varies from a low of 55 dB at 4:15 p.m. on July 1, to a high of 69 dB at 11:30 p.m. on June 30. Corresponding differences show up in the values of the delta

used to judge prominence of the fan tone at 158 Hz. This variation over a day makes it extremely unlikely that levels resulting from analysis of the short-term sampling times, of one second to 15 seconds, as used by the Agency, bear any relationship to the equivalent continuous sound pressure level over a longer and more reasonable period of observation. Using the 8-1/2 hours of test data, for the periods of the day and night when the plant was operating, we see average daily noise levels of 63 dB for the 160Hz 1/3 octave band, 66 dB for the 125 Hz octave band, and a delta of 7.5 for the 160 Hz 1/3 octave band containing the fan tone. GM asserts that the plant's sound emissions clearly comply with Rule 207, based upon a "reasonable" period of observation as permitted by ANSI.

GM's position, then, is that the Agency's tests of foundry and other community noises in Tilton produced skewed data. The data samples were too short to accurately evaluate whether the plant's sound levels violate Part 901, and that the misleading nature of the data was then compounded by the Agency's inaccurate version of the ANSI formula for determining equivalent continuous (or rms) sound pressure levels.

HISTORY OF THE BOARD'S NOISE REGULATIONS, USEPA NOISE STUDIES AND THE PROPOSAL FOR ONE-HOUR Leq AVERAGING

On July 26, 1973, the Board adopted Former Chapter 8 of the Illinois Pollution Control Board Rules and Regulations, Illinois' first comprehensive noise pollution control regulations. In its July 31, 1973 Opinion in support of the noise regulations, the Board described the regulations as "designed to protect people in the State from the unreasonable exposure to environmental noise burdens." Opinion of the Board, R72-2 at 20 (July 31, 1973). The entire record in R72-2 reflects a concern for establishing maximum noise levels based upon anticipated community response ("a regulation should be based on the likelihood of compliant"), as well as a concern that the standards adopted be economically and technically feasible. See Opinion R72-2, at 35-39 (extensive analysis of technical feasibility and economic reasonableness of proposed regulations).

The limits presently contained in Part 901 were established following an examination and analysis of community noise annoyance. In addition to the protection afforded to the general public by Part 901, Part 900 accommodated the specific individual by entitling that person to bring a complaint, under Section 900.102, that a particular noise source is emitting sound "so as to cause noise pollution in Illinois...."

Specific measurement procedures were not established by the Board in R72-2. In explaining the measurement procedure established in Rule 103, the Board stated:

> "This rule establishes the basic techniques to be used in measuring sound levels by reference to specific published standards such as those of the American National Standards Institute, Inc. (ANSI). Much testimony appears in the record, mainly from industry, urging that the techniques be specified in more detail as part of the regulation. This was felt to be impractical given the uniqueness of each measuring location in the state and the periodic development of new and more advanced techniques. Filing the techniques with the Secretary of State before applying them should give sufficient notice of their nature and provisions to interested persons. Application of the measurement techniques to specific situations must be done on an individual basis and could be a subject to challenge in an enforcement proceeding." Opinion, R72-2, at 23.

More specifically, the problem of measuring varying, non-steady noise emissions was not resolved in R72-2, primarily due to the absence of accurate and efficient instrumentation to measure such noise at that time. Indeed, the Board recognized the difficulty of measuring fluctuating sound in its Opinion on R72-2. At page 19 of the Board's Opinion, the following observation is found:

> "One last type of sound is fluctuating sound, where the sound pressure level varies with time. Some sirens emit noise that could be classified as fluctuating and there is also machine and process noise that varies regularly in sound level with time. Little information is available to determine its relative annoyance to non-fluctuating noise." (Emphasis supplied).

George W. Kamperman, the Agency's acoustical consultant in R72-2, confirmed the absence of available technology to measure non-steady, fluctuating noise at the time the Board considered R72-2 in a recent letter to Petitioner, in which Kamperman noted:

> "In 1972, I had independently developed laboratory instrumentation for determining the average sound level (Leq) for time varying sounds. There were no commercially available instruments for determining the average sound level when the proposed noise regulations became effective." Letter to Woodford Van Tifflin (April 13, 1981) at 2.

The availability of that instrumentation today is reflected not only in the testimony presented by Petitioner during the public hearings on R83-7, but is also noted by Kamperman:

> "In the past two years, several instrument manufacturers have started marketing portable microprocessor controlled sound level meters capable of computing average sound level." Id.

There was no evidence presented to the Board in R72-2 that community annoyance or community response to noise is best determined by measuring short duration maximum level noise emissions. Research completed subsequent to the adoption of the original noise regulations provides evidence to the contrary.

Such documentation is contained in the report of the United States Environmental Protection Agency (USEPA) entitled "Public Health and Welfare Criteria for Noise," published July 27, 1973 ("Criteria Document") (Exhibit P); a report of USEPA entitled "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety" ("Levels Document"), published in April, 1974 (Exhibit MM); a report of USEPA's former Office of Noise Abatement and Control ("ONAC") entitled "Toward a National Strategy for Noise Control," published in April, 1977; ANSI S3.23-1980 entitled "Sound Level Descriptors for Determination of Compatible Land Use"; ANSI S12.4-198X (June 1983 Draft) entitled "Method for Assessment of High-Energy Impulsive Sounds with Respect to Residential Communities"; and ISO Recommendation R1996 entitled "Assessment of Noise with Respect to Community Response," ISO/R 1996-1971 (before the Board in R72-2). Each of these documents provides support for Petitioner's claim that Leq averaging is clearly the most accurate descriptor of community response to noise.

The USEPA Criteria Document was prepared pursuant to the directive to the Agency contained in the Noise Control Act, 42 U.S.C. 4904(a), to develop and publish criteria with respect to noise which reflects "the scientific knowledge most useful in indicating the kind and extent of all identifiable effects on the public health or welfare which may be expected from differing quantities and qualities of noise." The Criteria Document stated that:

> "[i]n terms assessing the effects of noise on humans, Leq is one of the most important measures of environmental noise, since there is experimental evidence that it accurately describes the onset and progression of hearing loss. There is also considerable evidence

> that it applies to human annoyance due to noise." Criteria Document at 2-7.

After reviewing a number of other criteria used to rate community response to noise, the Report concluded that "to date [the] one measure of noise that appears to be emerging as one of the most important measures of environmental noise in terms of the effects on man is the Energy Mean Noise Level, Leq, ..." Id. at 2-10. This conclusion was based in part on a study undertaken by Task Group #3 of the USEPA on Aircraft/Airport Noise Study, which found that:

> "The °energy° equivalent, or average A-weighted sound level taken over a 24-hour period, with a 10-decibel penalty applied to nighttime sound levels, is the simplest noise measure that provides a high degree of correlation with annoyance, complaint behavior, and overt community reaction."

This conclusion was reinforced by the subsequently published Levels Document. This document, which was more concerned with establishing maximum levels rather than measurement procedures, nevertheless noted that criteria for describing time-varying community noise must take into account both the level and duration of the noise. The Levels Document concluded that:

> "[i]in order to describe the effects of environmental noise in a simple, uniform and appropriate way, the best descriptors are the long-term equivalent A-weighted sound level (Leq) and a variation with a nighttime weighting, the day-night sound level (Ldn) ..." Levels Document at 2.

The USEPA's recommended criteria levels are found in ONAC's report entitled "Toward a National Strategy for Noise Control." Here, the USEPA has proposed maximum levels represented in terms of the day-night average sound level (Ldn), measured over a 24-hour period. Numerous federal agencies have adopted maximum noise levels for projects under their jurisdiction expressed in terms of an average equivalent sound level, including the Department of Housing and Urban Development, see 24 C.F.R. 51.103 (1982), the Federal Highway Administration, see 23 C.F.R. 772 et seq, and the Federal Aeronautics Administration, see 14 C.F.R. A150.101(d) (1982).

The most recent ANSI publications on this point also recommend a time-varying measurement standard for establishing the appropriate noise level descriptors for determination of community response to noise. In ANSI S3.23-1980 (Exhibit Q), a day-night average sound level is adopted as the appropriate "acoustical measure to be used in assessing compatibility between various land uses and an outdoor environment." ANSI S3.23-1980

proposes a period of observation of twenty-four (24) hours. In a recent draft proposal providing for a method of assessement of high-energy impulsive sounds with respect to residential communities, ANSI reaffirms that "A-weighted day-night average sound level is the primary descriptor of environmental noise." See ANSI S12.4-198X (June 1983 Draft), at 1.

The International Organization for Standarization published ISO Recommendation R1996 in 1971. This document, which was introduced as an exhibit in the original proceedings on R72-2 and is referred to in several parts of the Board's Opinion on R72-2, suggests methods of measuring and rating noise in a manner "suitable for predicting approximately the public reaction likely to be caused by noise." ISO/R 1996-1971 at 3 (Exhibit S). At Section 3.1.5 the ISO document states:

> "If the noise varies with time in a more complicated manner than is appropriate for the use of Table 1, the equivalent sound level Leq should be obtained, for example from a statistical analysis of the time history of the A-weighted sound level."

When reviewing the existing national and international standards it is clear that the Leq and day-night average sound level (Ldn) measurement criteria are the most widely accepted measurement criteria utilized today for the measurement of community response to noise.

The Model Community Noise Control Ordinance was developed by The National Institute of Municipal Law Enforcement Officers and the Environmental Protection Agency, Office of Noise Abatement Control September, 1975. The Model Community Noise Control Ordinance, which sets forth guidelines for localities that are developing noise regulations, advocates averaging by utilizing the equivalent A-weighted sound level (Leq) over a time period of twenty-four (24) hours. The 24-hour averaging period suggested by the Model Community Noise Control Ordinance permits the exceedence of the prescribed decibel limits as long as the decibel level, as averaged over a twenty-four (24) hour period, does not exceed those limits.

As previously noted, GM has proposed a 1 hour, rather than a 24 hour Leq averaging system. This does not reflect GM's disagreement with the 24 hour method, but is proposed to aid enforcement by reducing sampling time by enforcement authorities. The Board also notes that, since the 1 hour Leq averaging could be enforced for a period of maximum hourly measurements, it could be more stringent than a 24 hr. Leq.

The Economic Record

No separate economic hearings have been held. In addition to the previously mentioned cost data presented by GM concerning

the enforcement scheme, the Agency's comments present data concerning the costs to the Agency of the rule change. These relate primarily to equipment costs and manpower costs.

Due to truncation of the Agency's noise control staff, an integral part of its program is the training of local enforcement officials to investigate noise complaints, through the use of sound monitoring equipment loaned them by the Agency free of charge. The Agency owns some 35-plus sound level meters, 15 of which were then on loan, none of which were capable of measuring Leq. GM presented evidence (Exh. CC) that adapters for existing equipment were available for about $1,000 per unit, which presumably would be borne by the Agency.

The Agency is also concerned about the increase in time spent in investigation of complaints. Using the fast scale measurement technique, the Agency asserts that 10-20 minutes are occupied in measurements; one hour or more could be spent in obtaining an accurate L_{eq} reading. In 1984, the Agency employed only two noise inspectors, responsible for investigating the 250 noise complaints filed with the Agency between September, 1982, and May, 1984. The Agency asserts that any additional time spent investigating complaints "could be terminal to the already extremely fragile program."

The final source of economic information is the DENR's letter determining that the cost of making a formal EcIS is unreasonable in relation to the value of a study to the Board. DENR made clear that this determination was made on the basis of review of the 1973 USEPA document "Public Health and Welfare Criteria for Noise," and ANSI S3.23-1980 (each of which were reviewed supra, p. 8). DENR agrees with GM's contention that:

> "(1) IEPA's 'grab sample' noise measurement technique is incorrect, and (2) the 'grab sample' technique is not an adequate descriptor for community annoyance."

DENR further stated that:

> The conclusion that IEPA has been measuring noise incorrectly, i.e., not is substantial conformity with ANSI under Rule 103(b), has had a significant impact on our analysis of the economic consequences of R83-7. Consider the following: if IEPA measurement procedures were in substantial conformity with ANSI, then R83-7 would redefine compliance for certain firms which were out of compliance because of their marginal short-term excursions of the noise standards. Because the IEPA procedures used to determine compliance are apparently erroneous, R83-7 does not redefine compliance; it specifies procedures for determining

compliance which are in accordance with ANSI and USEPA recommendations. R83-7 merely clarifies Rule 103(b) because the Board intended measurement procedures to track ANSI and intended noise regulation to reflect community annoyance.

With this interpretation in mind, an assessment of the economic consequences of R83-7 is relatively straightforward. The costs of the proposed regulation will be borne in large part by the IEPA. GM presented testimony on 11/22/83, which clearly delineate the cost of adapting IEPA noise level meters and other equipment to accommodate the 1 hour Leq measurement technique. The Department's independent calculations agree with those presented by GM. The IEPA will also bear added manpower costs because data collection in enforcement cases will require at least one hour of staff time. However, we believes that the unquantifiable benefit of having reliable data on noise emissions far outweighs the added manpower and other costs to the IEPA.

R83-7 may impose some costs on private firms which monitor their own noise emissions with noise meters which are incompatable with the 1 hour Leq. However few industries and especially few small businesses monitor their own noise. If an industry or small business wanted to monitor noise, an independent noise consultant would normally be hired. Municipalities will not be effected by R83-7 because the proposed regulation is only applicable to measurement techniques in enforcement cases (Part 2 of Chapter 8).

With respect to the benefits of R83-7, the principal benefit will accrue to the citizens of Illinois because the IEPA will be able to concentrate on those noise emitters which have an impact on health and welfare of the population. Other benefits will accrue to some noise emitters which the IEPA have determined to be non-compliant because of marginal short-term noise excursions, i.e., certain firms will not be required to implement controls because their noise does not violate the standards set forth by the Board" (DENR Letter of December 20, 1983, pp. 2-3).

The First Notice Proposal As Adopted By The Board

Based on the record amassed to date, the Board is adopting for first notice a modified version of GM's proposal. This reflects the Board's basic agreement with GM's contention that this is not a site-specific issue, and that current Agency noise measurement techniques are not in substantial conformity with ANSI, as intended by the Board in adopting the noise regulations. The Board's proposal tracks that of GM to the extent that it includes a 1 hour Leq averaging, except as applied to blasting noise; the blasting noise exception is important to maintain relative consistency with federal mining regulations. See Opinion, R80-9/10. Ambient sound correction is provided for. The impulsive noise rule is amended to delete the required use of noise measurement by a fast dynamic characteristic, to conform with the amendments to the measurements rule.

The Board has, however, added a procedure to allow for justification of use of alternative measurement procedures where it can be demonstrated that such alternative procedures provide a higher degree of correlation of the characteristics of the sound emission to human response. This provision is included, in part, to allow for adjustments in situations such as those "noise sources about which the Agency receives complaints opera[ting] as little as 1/2 hour per week." See Agency Comments, p. 12. However, it also reflects concerns not fully addressed in this record, which dealt mainly with prominent discrete tones as an example, concerning possible unintentional blunting of the impulsive noise rules,* particularly as they relate to noises of high magnitude but short duration.

Specific Request for Comments

The Board poses the following hypothetical, which it wishes to have addressed. Consider a noise source which is quiet (= 0 dB) most of the time, but which lets out an occasional very loud noise of short duration (i.e., an impulsive noise). Consider further that the noise source is on Class C land, and that the noise is received on Class A land.

The modifications would appear to allow this source to contribute noise at the receiving site as long as the combination of the intensity of the source noise and the duration of the

* In this context, the Board must initially note that the only two examples of impulsive sound contained in the Section 900.101 definitions of impulsive sound are "drop forge hammer and explosive blasting", an example added in the R80-9/10 proceeding. See also examples in R72-2 Opinion, p. 18: "blasts, hammering, impact of drop forges, and punch presses." Neither blasting noise nor forging noise is measured for compliance by use of fast dynamic characteristics: the former is measured by a slow dynamic characteristic, and the latter with a 1 hour Leq.

noise, over any given hour, does not produce an Leq in excess of 56 dB during the day and 46 dB during the night.

This scenario would allow the sounds and durations as shown in the following table. Note that the sound level is the level at the receiving site, not the source site. Due to attenuation, the sound closer to the site would be assumed to be still louder.

Permissible Duration
During Any Given 1 Hour

Sound Level	Day	Night
100 dB	.14 sec	.014 sec
90 dB	1.43 sec	.14 sec
80 dB	14.3 sec	1.43 sec
75 dB	45.3 sec	4.53 sec
70 dB	2.4 min	14.3 sec
65 dB	7.6 min	45.3 sec
60 dB	23.9 min	2.4 min

Some quite loud noises, over some substantial durations, would thus be allowed. Moreover, the noises need not be in single pulses each hour. For example, the 14.3 sec of 80 dB noise during the day could come as ten separate pulses of 1.43 sec duration each hour.

A further perspective can be gained by reflecting on Exhibit II, Figure 4, which is discussed at R. 325-328. GM asserts that the impulsive noise in Figure 4 would be less objectionable than the steady noise of Figure 3, and by presumed extension that the Figure 4 noise is fundamentally unobjectionable. Perhaps in the case of the numbers given this conclusion is correct. However, what if the noise pulse in Figure 4 were not a small 2 dBs above the theoretical standard, but some higher value? The pulse could be as high as 83.7 dB (15 sec duration), and the Leq would still be within the 60 dB limit. Alternatively, there could be pulses of 83.7 dB of 1 sec duration averaging four minutes apart. Given this scenario of 15 aggregate seconds of 83 dB every hour, should this be judged as less objectionable than the Figure 3 data, or unobjectionable overall?

The Board also requests comment on the relationship of sound limitations in Sections 901.102 and 901.103, and the sound limitations in Section 901.104 as applied to this rulemaking.

In addition to comment on these technical points, the Board specifically requests comments on the workability of the alternative justification procedure, as well as on the economic effects of adoption of this change. Finally, the Board is hopeful that first notice publication of this proposal will elicit comment from the public and the regulated community concerning this state-wide rule change.

ORDER

The Clerk shall cause first notice publication of the following proposed amendments in the Illinois Register:

Title 35: Environmental Protection
Subtitle H: Noise
Chapter I: Pollution Control Board

Section 900.101 Definitions

Human Response: the effect of noise on people, including physiological effects such as damage to the ear and permanent or temporary hearing loss and psychological effects such as interference with sleep or speech communication, annoyance, and loss in physical or mental efficiency.

Section 900.103 Measurement Procedures

(a) No change

(b) Procedures Applicable Only to 35 Ill. Adm. Code 901

1) All measurements, and all measurements procedures, to determine whether emissions of sound comply with 35 Ill. Adm. Code 901 shall be in substantial conformity with ANSI S1.6-1967, ANSI S1.4-1971 -- Type I Precision, ANSI S1.11-1966 and ANSI S1.13-1971 Field Method, and shall, with the exception of measurements to determine whether emissions of sound comply with 35 Ill. Adm. Code 901.109, be based on Leq averaging, as defined in 35 Ill. Adm. Code 900.101, using a reference time of one hour. All such measurements and measurements procedures shall correct or provide for the correction of such emissions for the presence of ambient noise as defined in ANSI S1.13-1971.

2) Alternative measurement procedures may be used which are not based on Leq averaging or which use a measurement time other than one hour upon a demonstration pursuant to 35 Ill. Adm. Code 901.130 that alternative measurement procedures provide a higher degree of correlation of the characteristics of the sound emission with human response than do the measurement procedures of subsection (b)(2) above.

(c-e) No change

Section 901.104 IMPULSIVE SOUND

Except as elsewhere in this Part provided, no person shall cause or allow the emission of impulsive sound from any property-line-noise-source located on any Class A, B, or C land to any receiving Class A or B land which exceeds the

allowable A-weighted sound levels~~, measured with fast dynamic characteristic~~ specified in the following table when measured at any point within such receiving Class A or B land, provided, however, that no measurement of sound levels shall be made less than 25 feet such from property line-noise-source.

Section 901.130 Demonstration of Applicability of Alternative Measurement Procedures

1) This section specifies procedures for demonstrations, pursuant to Section 28.1 of the Act, that the otherwise applicable measurement procedures of 35 Ill. Adm. Code 900.103(b) should not be used by the Board in determining that sound emissions comply with this Part. Such demonstrations may also be made in variance, enforcement, and regulatory proceedings.

2) The burden shall be on the party requesting use of an alternative measurement procedure to plead and prove that such alternative procedure provides a higher degree of correlation of the characteristics of the sound emission with human response than use of the measurement procedure specified in 35 Ill. Adm. Code 900.103(b). Such party's initial pleading shall include a specification of the alternative measurement procedure to be employed and a justification of such procedure. Such justification shall describe the characteristics of the sound emission being measured and shall contrast the standard and alternative procedure's correlation to human response factors.

3) The other, non-requesting, parties shall file a responsive pleading within 21 days of the filing of the initial pleading, indicating their agreement or disagreement with use of an alternative measurement standard, and reasons therefore.

4) Each party may present additional evidence and argument in support of its position at any hearing held in the action.

5) In making a determination pursuant to this Section, the Board will consider the pleadings and any hearing record. The Board will issue an order and enter a written opinion stating the facts and reasons leading to its decision to approve or disapprove use of an alternative measurement procedure.

IT IS SO ORDERED.

J. Marlin concurred.

J. D. Dumelle, B. S. Forcade, and J. T. Meyer dissented.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Proposed Opinion and Order was adopted on the 7th day of November, 1985, by a vote of 7-3.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board